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Reply to Office Action of August 14, 2006

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Atty Dkt No. NTS 0102 PUS

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A reamer for enlarging a pre-existing hole in a workpiece by rotational and axial cutting, the reamer comprising:

a longitudinal shank for supporting a body of a reamer for enlarging a pre-existing hole in a workpiece by rotation and axial movement relative to the workpiece in a first hand rotational direction; and

a longitudinal body extending axially from the shank, the body having at least one first flute formed therein, providing at least one first flute cutting edge in a distal end of the body for imparting a first cutting operation to the workpiece, the body having at least one helical flute formed therein at an angle relative to an axis of rotation that is greater than that of the at least one first flute, the at least one helical flute being formed in a second hand rotational direction opposite to the first hand rotational direction so that cutting debris is advanced ahead of the at least one helical flute, the at least one helical flute providing at least one helical flute cutting edge in the body distal end, radially spaced apart from the at least one first flute cutting edge, for imparting a helical cutting operation to the workpiece so that at least a leading portion of the at least one first flute and the at least one helical flute cutting edges generally lie in a common radial plane, wherein the body includes at least one cylindrical margin formed thereabout for providing bearing support to the reamer within the hole being formed;

wherein the at least one first flute cutting edge and the at least one helical flute cutting edge concurrently and collectively perform the first and helical cutting operations to a sculpture surface of the workpiece, thereby improving tolerances of the cutting operations to a range of at least 0.001 inches, varying the loads imparted to the workpiece and the reamer, and reducing heat generated between the workpiece and the reamer.

2. (Original) The reamer of claim 1 wherein the at least one first flute is further defined as at least one straight flute.

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3. (Original) The reamer of claim 1 wherein the at least one first flute cutting edge is further defined as at least one straight flute cutting edge.

4. (Original) The reamer of claim 1 wherein a longitudinal dimension between the at least one first flute cutting edge and the at least one helical flute cutting edge is less than ten percent of an overall transverse dimension of the reamer body.

5. (Original) The reamer of claim 1 wherein the body is generally cylindrical.

6. (Canceled)

7. (Original) The reamer of claim 1 wherein the longitudinal body has an imaginary plane extending axially through the axis of rotation, and the at least one first flute is formed ahead of the imaginary plane in the first hand rotational direction thereby providing a negative rake angle to the at least one first flute cutting edge.

8. (Original) The reamer of claim 1 wherein the longitudinal body has an imaginary plane extending axially through the axis of rotation, and the at least one helical flute is formed ahead of the imaginary plane in the first hand rotational direction thereby providing a negative rake angle to the at least one helical flute cutting edge.

9. (Currently Amended) The reamer of claim 1 wherein the cylindrical margin extends longitudinally along the body ~~includes at least one longitudinal margin~~ generally aligned with the at least one first flute for providing bearing support to the reamer within the hole being formed.

10. (Currently Amended) The reamer of claim 1 wherein the cylindrical margin extends helically along the body ~~includes at least one helical margin~~ generally aligned

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with the at least one helical flute for providing bearing support to the reamer within the hole being formed.

11. (Original) The reamer of claim 1 wherein the body further includes at least one gash formed in the body distal end extending outwardly in relation to an axis of rotation and intersecting the at least one first flute and the at least one helical flute for assisting removal of debris from the at least one helical flute cutting edge.

12. (Original) The reamer of claim 1 wherein the shank includes an ingress port for receiving a cutting fluid and for transmitting the cutting fluid through a fluid passage, and the body includes at least one egress port connected to the fluid passage and formed within either of the at least one first flute and the at least one helical flute for conveying the cutting fluid to the associated cutting edge and the sculpture surface defined within the workpiece.

13. (Original) The reamer of claim 1 wherein the body further includes at least one relief surface formed at least partially along the at least one helical flute cutting edge, the at least one relief surface having a first relief angle which is inclined in relation to a radial plane and a direction of cutting edge travel, the body including at least one other relief surface formed at least partially along the at least one first flute cutting edge, the at least one other relief surface having a second relief angle that is less than the first relief angle.

14. (Original) The reamer of claim 1 wherein the at least one first flute cutting edge comprises a leading edge inclined in relation to a radial plane.

15. (Original) The reamer of claim 1 further comprising a pilot extending axially forward from the body distal end, the pilot being sized to be received within the pre-existing hole to provide bearing support to reamer within the hole being formed.

16. (Original) The reamer of claim 1 wherein the at least one first flute cutting edge comprises an end cutting edge formed at an intersection of the at least one first

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flute and the distal end of the body, and a leading edge inclined in relation to a radial plane.

17. (Previously Presented) The reamer of claim 1 wherein the body further includes at least one primary relief surface formed along the at least one first flute cutting edge having a primary relief angle.

18. (Previously Presented) The reamer of claim 17 wherein the body further includes at least one secondary relief surface formed along the at least one primary relief surface spaced apart from the at least one first flute cutting edge having a secondary relief angle that is greater than the primary relief angle.

19. (Original) The reamer of claim 1 wherein the at least one first flute further comprises an array of first flutes.

20. (Original) The reamer of claim 19 wherein the array of first flutes has an angular spacing tolerance between sequential first flutes that is equal to or less than four radial quadrants divided by twice the number of first flutes in the array in order to vary the loads imparted to the workpiece and the reamer.

21. (Original) The reamer of claim 1 wherein the at least one helical flute further comprises an array of helical flutes.

22. (Original) The reamer of claim 21 wherein the array of helical flutes has an angular spacing tolerance between sequential helical flutes that is equal to or less than four radial quadrants divided by twice the number of helical flutes in the array in order to vary the loads imparted to the workpiece and the reamer.

23. (Original) The reamer of claim 1 wherein the at least one first flute further comprises an array of first flutes and the at least one helical flute further comprises an array of helical flutes.

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24. (Original) The reamer of claim 23 wherein the number of first flutes in the first flute array is equal to the number of helical flutes in the helical flute array.

25. (Original) The reamer of claim 23 wherein the number of first flutes is equal to three.

26. (Original) The reamer of claim 23 wherein the number of first flutes is equal to five.

27. (Original) The reamer of claim 23 wherein each first flute cutting edge is radially spaced apart from each helical flute cutting edge at the reamer body distal end.

28. (Currently Amended) A reamer for enlarging a pre-existing hole in a workpiece by rotational and axial cutting, the reamer comprising:

a longitudinal shank for supporting a body of a reamer for enlarging a pre-existing hole in a workpiece by rotation and axial movement relative to the workpiece in a first hand rotational direction; and

a longitudinal body extending axially from the shank, the body having at least one first flute formed therein, providing at least one first flute cutting edge in a distal end of the body for imparting a first cutting operation to the workpiece, the body having at least one helical flute formed therein in a second hand rotational direction opposite to the first hand rotational direction so that cutting debris is advanced ahead of the at least one helical flute, the at least one helical flute being non-intersecting with the at least one first flute at the body distal end, the at least one helical flute providing at least one helical flute cutting edge in the body distal end, radially spaced apart from the at least one first flute, for imparting a helical cutting operation to the workpiece, wherein the body includes at least one cylindrical margin formed thereabout for providing bearing support to the reamer within the hole being formed;

wherein the at least one first flute cutting edge and the at least one helical flute cutting edge concurrently and collectively perform the first and helical cutting operations to a sculpture surface of the workpiece, thereby improving tolerances of the cutting operations

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to a range of at least 0.001 inches, varying the loads imparted to the workpiece and the reamer and reducing heat generated between the workpiece and the reamer.

29. (Currently Amended) A method for reaming a pre-existing hole, the method comprising the steps of:

providing a reamer having a body with at least one first flute with at least one first flute cutting edge in a distal end of the body-reamer, the body-reamer having at least one helical flute formed therein canted relative to the at least one first flute, with at least one helical flute cutting edge in the distal end of the reamer, wherein the body includes at least one cylindrical margin formed thereabout for providing bearing support to the reamer within the hole being formed;

rotating one of the reamer or a workpiece; and

translating one of the reamer or the workpiece towards another so that the reamer is fed into the pre-existing hole, and the at least one first flute cutting edge and the at least one helical flute cutting edge concurrently and collectively provide cutting operations to a sculpture surface formed within the pre-existing hole with a tolerance range of at least 0.001 inches.

30. (previously presented) The reamer of claim 1 wherein the tolerances of the cutting operation are plus or minus 0.0005 inches.

31. (previously presented) The reamer of claim 1 wherein the tolerances of the cutting operation are plus or minus 0.0003 inches.

32. (Canceled)

33. (new) The reamer of claim 1 wherein the cylindrical margin has a diameter generally equivalent to that of the hole being formed.

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34. (new) The reamer of claim 1 wherein the cylindrical margin has a width of at least 0.008 inches.

35. (new) The reamer of claim 1 wherein the cylindrical margin has a width of 0.008 to 0.020 inches.

36. (new) The reamer of claim 28 wherein the cylindrical margin extends longitudinally along the body generally aligned with the at least one first flute for providing bearing support to the reamer within the hole being formed.

37. (new) The reamer of claim 28 wherein the cylindrical margin extends helically along the body generally aligned with the at least one helical flute for providing bearing support to the reamer within the hole being formed.

38. (new) The reamer of claim 28 wherein the cylindrical margin has a diameter generally equivalent to that of the hole being formed.